UNIVERSITY OF NOTTINGHAM

DEPARTMENT OF PSYCHOLOGY

The Evaluation of the St. Dunstan's Manual of Instruction for the Kay Sonic Aid:

by

Robert Sharpe.

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Summary.

Four sighted subjects were trained under the blindfold with the Sonic Aid following the Instruction Manual issued by St. Dunstans. With daily periods of instruction it took them an average of fourteen calendar weeks to complete the course. By the end of that time their performance on tests prescribed by the manual and specially designed tests was very satisfactory while their performance over two routes was comparable to that of self-taught Sonic Aid users and somewhat better than that of sighted subjects trained under the blindfold for four calendar weeks on long-cane/orientation. The present subjects were also capable of identifying a large number of street objects using Investigation techniques with the Aid.

Recommendations are made concerning blind persons likely to benefit from training; the use of trained instructors; and the modification of present training structure.

Contents.

A Comment. (i)

E. Elliott. Member of St. Dunstan's Scientific Committee and Author of the Manual.

Although several gifted people have shown enthusiasm for the Sonic Aid and apparent proficiency in using it, there has always been the suspicion and sometimes direct evidence that well-established mobility habits and general sensory cues have played the major part in their success. Attempts at trining groups of volunteers have not been particularly successful, chiefly because too little time has been devoted to these experiments and, in particular, too little preparation has been given to planning the training schedules. The St. Dunstan's Training Manual for the Sonic Aid probably has cost more man-hours to plan and produce than any other evaluation in its e tirety. Robert Sharpe's evaluation of the Manual has added a further large cost in scientific manpower; and, therefore, it is with pleasure tempered with relief that I have seen his work succeed even beyond expectations. We are now at last in the position where we can say that we know how to teach a blind man how to use the Sonic Aid, and we know that he can reasonably expect his efforts to be rewarded with

proficiency in mobility comparable with that he might have using the long-cane or a guide-dog. Professional mobility instructors also should be encouraged now to devote attention to the special training problems encountered with the Sonic Aid.

The framework of St. Dunstan's Manual is a detailed analysis of the skills involved in travel with the Sonic Aid. It was written for use by a blind learner and a sighted friend; and it was necessary to try to encourage the friend to use good teaching techniques. The professional instructor will not need so much instruction in methods of instruction; but, while he is learning to use the Sonic Aid himself, the detailed commentaries for the guide and the emphasis on teaching objectives may well be useful. Once he is prepared to teach his first blind learner he will want to modify the rigid routines laid down in the Manual. Appendices A and B of this report make some suggestions for abbreviated courses, which will serve as guidelines for use at least with the most apt pupils, although I strongly suspect that quite so much reduction of the course content will not often prove successful. But the plain fact is that we cannot expect to devise out of hand a perfect training course for skills as complex as these. We have

to anticipate a series of changes and improvements in the teaching techniques as experience develops, and I very much hope that we shall see such progress made in the next year or two.

Preface

by

J.A.Leonard.

This report deals with the latest of a series of evaluations carried out with the Sonic Aid and it comes almost nine years after Professor Kay first approached St. Dunstans with a proposal for work on a binaural ultrasonic guidance device. By the autumn of 1961 the Scientific Committee of St. Dunstan's had agreed to provide support for a monaural device and had asked the Director of the Applied Psychology Research Unit (M.R.C.) Dr. D.E. Broadbent, for assistance in carrying out an evaluation with the first 10 prototypes to be produced by Ultra Electronics. This first evaluation was carried out by Dr. Carpenten and myself [4] in the Spring and Summer of 1962 and a report submitted to St. Dunstan's in the autumn of that year. The report, while recognising the potential of the aid, contained a recommendation that no further work on the Sonic Aid should be carried out until more basic research into the wider problems of the mobility of the blind had been undertaken. This recommendation was not accepted and St. Dunstan's, Ultra Electronics, and N.R.D.C. agreed to produce a second batch of 100 aids to be issued for further evaluation studies to appropriate bodies. A working party was set up to co-ordinate the proposed production and, in

anticipation of the release of that second batch, I submitted a proposal to the Scientific Committee in the autumn of 1963. In it a recommendation was made for the development of a formal training plan and the use of sighted instructors. The second batch of 100 aids was released during the Spring of 1965, at about the same time that Mr. Elliott agreed to develop a training manual on the basis of an evaluation to be carried out under his direction and funded by St. Dunstan's. This evaluation started early in 1966. At the same time a number of other evaluations and field trials were already in progress in different parts of the world. A good part of the time at the St. Dunstan's Conference on Sensory Aids in the early Summer of 1966 [8] was devoted to reports and discussions of these various evaluations. The upshot of these was encouraging in the sense that there was a small number of blind people who expressed satisfaction with the aid and were prepared to carry on using it; and discouraging in that the actual knowledge about the potential usefulness of the aid had not really been advanced.

Mr. Elliott concluded the first phase of his first evaluation and bagan work on the Manual in the autumn of 1967. Round about the same time Ultra Electronics released the first of their third batch of 1000 aids, the Sonic Aid Mark II. Earlier on that year St. Dunstan's and R.N.I.B. jointly issued two statements setting out the 'state-of-the-art' as far as the sonic aid was concerned, and one of these was eventually published

as an Editorial in the May, 1968 issue of the New Beacon.[9] This explained the operation of the Aid and summarised the available evidence up to that date. "St. Dunstan's and the R.N.I.B. regard the instrument in its present form as an experimental device and are unable to make positive recommendations until further field trials by blind users have been completed." By the autumn of 1968 Mr. Elliott reported on the progress of the Manual to the Scientific Committee and it was then decided that the time had come to subject the Manual for a formal and intensive evaluation.

Since the end of the 1962 evaluation, I had been working on the wider and more general aspects of blind mobility, and since 1965 this work has been centred on the Department of Psychology at Nottingham. Working with the support of the Medical Research Council, the Viscount Nuffield Auxiliary Fund, and St. Dunstan's, we have been building up a fairly comprehensive picture of the problems involved and the solutions available, as well as developing a range of methods for investigation. We have been working in close collaboration with blind people and the instructors of different modes of Mobility.

Among the blind people were any of those who had expressed themselves as 'satisfield sonic aid users' and we were struck by the fact that all who had taught themselves, and had achieved not merely satisfaction but also proficiency, had been highly competent travellers before starting to use the aid. The two people observed with the highest competence early in 1969[1] had a

long-term background of guide-dog use.

From long-cane/orientation training we had taken over two concepts of particular relevance in the present context: the general applicability of pre-cane, basic mobility skills and the use of sighted subjects working under the blindfold in parallel with using blind subjects.

In the autumn of 1968 I proposed to the Scientific Committee an evaluation of Mr. Elliott's Manual[3] with sighted subjects, the work to be completed by the summer of 1969.

Mr. Robert Sharpe was appointed in October of that year, spent the first three months in becoming familiar with the general area and the Manual, and carried out the actual evaluation during the next four months.

It is with a sense of pleasure and satisfaction that in presenting this report I am able to honour the commitment to St. Dunstan's undertaken last autumn. Our sincere hope is that this evaluation will make it possible for a number of blind people to be trained in the use of the Sonic Aid and that in this way Edward Elliott's great work in writing the Manual can be brought to full fruition.

1. Aim of the Present Evaluation.

The aim of this work was to evaluate the capabilities of the Kay Sonic Aid as taught by the St. Dunstan's Instruction Manual[3]. Several goals were considered while undertaking this research:

1.1 The role of the Sonic Aid in relation to other forms of mobility aid.

The intention here was to compare the Sonic Aid trainees with Long Cane trainees in order to assess the attributes and difficulties of Sonic Aid travel/orientation which might not apply to the Long Cane. It was hoped that the trained Sonic Aid travellers would be able, in general, to perform in terms of speed and accuracy in a comparable way to travellers using the more well established techniques - especially the Long Cane.

1.2 Utilisation of the full potentialities of the Sonic Aid:

It was hoped that the trainee, after receiving the course of 24 lessons which the Manual involves, would be able to accomplish perceptual tasks involving the full potentialities of the language of the Aid. Thus, ideally the Aid would be used by these trainees not only as a clear path indicator but also as a detailed environment sensor.

1.3 Establishing of training times:

The Manual was seen to comprise certain high level and certain low level skills. The completion of each of these skills provided quite distinct landmarks in time during the overall training and it was hoped that some measures of skill performance at various stages in the course would emerge. The usefulness of such knowledge would be apparent to any future trainee as the trainer would be in a position to tell him (i) how long, on average, the whole course would take, (ii) roughly what he would be capable of after a stated period of time and (iii) how long he would take to learn a specific skill.

1.4 Provision of Simplified Manuals for specific purposes:

Since many blind travellers are not particularly interested in detailed environment sensing it was thought that such a comprehensive course as that provided by the Manual might not appeal to or be appropriate for some potential users. It was considered possible that the structure of the Manual might be amenable to having exercises for separate mobility skills taught out of context of the whole course. Thus, the sections relevant to clear path shoreline travelling alone could be taught to such people initially and the more detailed environment investigation exercises added if and when the traveller desired. It was hoped that the feasibility of "tailoring" the Manual to fit individual cases could be assessed.

1.5 Examining the role of sighted friend as Instructor:

The Manual is written for the trainee and a sighted friend who acts as guide. This friend need not necessarily have training experience and instructions are kept accordingly simple. It was of considerable interest to investigate whether such an informal approach was very viable or whether the training could not be better accomplished by a trained instructor - at a residential centre, day centre or domiciliary.

2. The Procedure.

This chapter will contain sections on the subjects used, the training schedules, the actual training methods used and the scoring and assessing techniques.

2.1 The Subjects:

Four sighted subjects were used under the blindfold for this evaluation. It is accepted that final evaluation of any device or training scheme for the blind must obviously be carried out with blind subjects so as to encompass all the relevant attributes of the state of permanent blindness as distinct from the temporary absence of vision. Since this is the first major exercise carried out with sighted subjects under the blindfold rather than with blind subjects it is necessary to make the role of "sighted simulators" quite explicit.

The "simulators" can be used to determine the extent to which a device or a training method enables one to make effective use of non-visual information, e.g. to move through geographical space and to identify objects. As long as one takes certain methodological precautions, e.g. ensures the effectiveness of the blindfold and does not allow the subjects to see the training area before the conclusion of the exercise one is entitled to

make statements about the effectiveness of non-visual information handling. The question is how far one is entitled to generalise form results obtained from blindfold sighted subjects to blind subjects. The answer depends on the importance which one attaches to those factors which make the difference between a permanent state of blindness and temporary absence of vision. These factors are primarily in the areas of motivation, attitudes, perception and cognition. It is probably true to say that the generalisations from sighted blindfold subjects to adventitiously blinded subjects would be more meaningful than generalisations to congenitally blinded ones.

The case for using "simulators" is based primarily on the long-standing experience of long cane/orientation training where the practice of training sighted instructors under the blindfold to the highest standards of non-visual mobility has been of great benefit to both blind and sighted alike. This, however, was only possible because the achievements of the sighted instructors could be compared at all times with those of blind clients. These training establishments provided a meaningful context in which the sighted under the blindfold were expected to perform at least as well as the blind. They also ensured as far as possible that the blindfolding was effective and that the sighted did not see the training areas etc., before or during any exercise. These are the main points of methodology which have been taken over for this evaluation from long cane/orientation training.

From the experimental points of view there are three advantages, possibly interrelated, of carrying out work with "simulators":

2.2 Ethics:

Until one is tolerably certain that one has something sound to offer blind subjects, one is reluctant to use them. More particularly one is reluctant to insist on their acquiring skills which may or may not be of benefit to them and may even be detrimental. This is all the more the case where long periods of training may be involved.

2.3 Availability:

It is clearly much easier to ensure the daily availability of sighted subjects, in a University setting for instance, than that of blind subjects. And it is also easier to exert the necessary experimental control over them.

2.4 Already established methods of mobility:

Many blind travellers have already built up an elaborate system of "natural" mobility skills and are capable of fairly high levels of mobility independent of artificial mobility aids. These personal systems are often not quantifiable or indeed definable so that such people, after training on the Sonic Aid, cannot be said with any certainty to be using the Aid as a primary mobility device. Armstrong (1969)[1] for instance, demonstrated that two very competent self-taught Sonic Aid users were

probably only using the Aid to confirm what they had already detected about their environment by natural means. The blindfold sighted subjects used in the present evaluation, however, had probably not built up these non-visual mobility techniques to such a sophisticated degree as some blind people, since it had not been so necessary. Thus, it was assumed that any improvement in the subjects performance would be due primarily to the use of the Aid - i.e. the Aid would be used as a primary device to a greater extent than it would if an already mobile person were using it.

In summary, then, the least one can say on the basis of achievements of sighted subjects under the blindfold in a controlled and meaningful context is that a device and/or a training method has a specifiable effectiveness in the absence of vision. If the experience of long cane/orientation training is accepted as relevant, one has a fair amount of justification for generalising from the achievements of the "simulators" to that of blind subjects. Final evaluation must still be carried out with blind subjects, but this is made very much easier as a result of prior work done with blindfold sighted subjects.

2.5 Brief description of J.A.

A male first year postgraduate psychology student. Very self-confident throughout the training and did not appear to suffer a great deal of anxiety about learning the skills or about any mishaps which might befall him during the training. He always

walked confidently and took an interest in the evaluation itself.

2.6 Brief description of H.K.

A female first year postgraduate psychology student. She also was confident and carried out her training instructions well. She was a very temperamental subject, however, and was always very concerned as to whether she was doing as well as the others. She had considerable postural problems early on in the training and these had to be corrected before much progress could be made. There was not much interest in the evaluation exercise itself - it was considered more as a job.

2.7 Brief description of H.S.

A female first year undergraduate psychology student. She was initially a very confident subject but as the skills became more complex she became more and more prone to anxiety and temperamental fluctuations in performance. Again, not much interest in the evaluation here. She was always acutely anxious about hurting herself while under the blindfold. However, she was quite often capable of displaying exemplary travel with the Aid.

2.8 Brief description of D.G.

A male first year undergraduate psychology student. He was a highly anxious and tense subject, who always seemed anxious that he was not doing well - even when he was. His stiffness, which was always very marked, was a great handicap. However,

he showed considerable enthusiasm and interest in the evaluation.

Method of Training.

2.9 Pretraining on the basic mobility skills.

One important difference between the present training procedure and that of the Manual was that the subjects in this evaluation were first given approximately one week of training in the basic mobility skills - trailing off, squaring up etc. - using the short cane. This served two purposes: (a) during the week of basic skills training the subjects gained confidence in the Experimenter and in themselves and became acclimatised to working under the blindfold and (b) it served to solve very quickly some of the difficulties which these subjects would otherwise have considered almost insurmountable - e.g. finding a door handle could have been very frustrating had not the simple technique been taught and crossing roads could have been both difficult and dangerous had they not been taught the techniques of indenting and goose-stepping for the upkerb. Thus, by the time the Sonic Aid was introduced to them the subjects were already gaining in confidence andfairly well mobile and the Aid appeared quite naturally as just another technique to be learned.

2.10 Training on the Sonic Aid with the Instruction Manual.

The rest of the procedure used for training the subjects was as set down by the Manual.

2.11 Preparatory Subskills.

These were very low level skills designed to prepare the trainee for attempting the later higher level skills with the Aid. They included such tasks as estimating accurately distances from objects; scanning across single and multiple arrays of canes; moving the Aid, by wrist movements, through the correct scanning arc (while stationary); exercises teaching the correct rate of scanning and making investigatory sweeps across objects; exercises preparatory to negotiating pedestrians.

2.12 Preparatory tape recordings.

The tape recordings, which were approximately 15 minutes in length were organised so that there would be one recording for each lesson starting from lesson 3. They contained examples of the sounds to be expected from the particular lesson, and tests to be carried out before and after the exercise. For example, there was a large series of tests involving taped sounds from the Aid the pitches of which had to be identified by the trainee in terms of the distance it represented from the reflector. Also, in the environment sensing exercises, there were tests on multiple sound patterns which the trainee was required to identify and state what were the dimensions, surface textures etc., of the object involved. The most complex recording was an example of the sounds heard in a walk along a street, and an interpretation of them.

2.13 Obstacle avoidance exercises.

These were for the detection and negotiation of both mobile (pedestrians etc.) and stationary obstacles. The exercises were examples of the type of vigilance task which the subjects would have to perform when in a street situation. Specialised techniques were included in these exercises for the negotiation of mobile, high and low obstacles, and these were evaluated as to their efficacy, .

2.14 Beam width exercises.

Since the beam of ultrasonic energy emitted by the Aid is not parallel sided, but spreads outwards in a cone from the Aid, it follows that there is a direct relation between the spread of the beam and the distance from the Aid. Various exercises were included in the Instruction Manual for using this relation to judge width of gaps between obstacles.

2.15 Surface identifications and discriminations.

A series of exercises and taped examples and tests was included in the Manual. The object was to train the Aid user to distinguish various types of shoreline so that he could use this skill in picking out landmarks on familiar routes. These exercises were assessed.

2.16 Walking and Scanning with the Aid (Clear Path Travel)

This high level skill was learned by a progressive parts

technique. First the trainee monitored his shoreline continuously while walking and later incorporated a scanning movement with the Aid so that the shoreline was monitored on every other pace, and the path ahead was checked to ensure that no obstacles were present.

There was a slight deviation from the procedure intended by the Instruction Manual in the scanning technique. The intention was for the Aid to be pointed left as the left foot advanced, front, and right as the right foot advances in discrete movements. However, due to a slight ambiguity in the instructions, the subjects were taught to make the scan a continuous smooth motion from left to right and back.

2.17 Investigation or Environment Sensing.

Again a high level skill learned by progressive parts. The trainee first learned a special horizontal sweep of the Aid which gave him information about his environment in the horizontal direction. Then later a vertical sweep was added which resulted in information being received about both horizontal and vertical dimensions, textures etc. of the environment. Thus, objects were at worst to be described in terms of dimension and texture and at best to be named.

2.18 Free use of the Aid.

The Manual advocated as much free use of the Aid as possible for the trainees. This was to encourage them to

experiment with their newly acquired skills and implement them. As far as was possible this was done, though not to a great extent as there was only one Aid available for use by all the 4 subjects.

2.19 Training Schedules.

The subjects all had one training session, lasting for about three quarters of an hour, each weekday. Occasionally days were missed if the subjects were unavailable but overall the regularity of the subjects' appearance for training was exceptionally good. Often missed sessions were compensated for by having double sessions on other days. About two-thirds of the way through the course 3 weeks were missed by all the subjects for a vacation. In compiling the results, weekends were included in overall times even though no training was carried out then, but the three weeks vacation was not included. In the results two methods of timing were used:

(i) The number of calendar days, including weekends and excluding the three weeks vacation, from a certain point in Sonic Aid training up to any other stage (referred to in the rest of the report simply as "days") and,

(ii) Number of actual training hours spent on all of the skills or on any one of them (referred to in the rest of the report as "training hours"). It should be understood that these training hours could only be roughly estimated.

Thus, for example, the statement that it took 28 days to

reach a certain stage means that about 20 sessions were needed, or approximately 15 training hours.

Scoring and Assessing.

2.20 Continuous Assessment.

In the early lessons it was fairly easy to score the subjects' performance since the skills were of a low level - such as estimating when they were further or nearer a wall than 3', or locating two canes in the beam of the Aid and walking between them. In such simple cases it was easy to score errors and to make judgements as to whether the subject was proficient at the skill and could pass onto the next. This was all that the Manual required the trainer to do and although complete records of the subjects performances were kept, the data was presented for the report in a more meaningful, summarised form.

In later lessons, however, scoring became more difficult. For example, it was a very arbitrary decision as to whether a slight veer from mid-pavement when following a shoreline should count as an error or whether an error should be scored if the subject bumped the shoreline or fell off the kerb. The usual criteria here were that the subject would be expected to veer very little when following a simple shoreline - and the scoring would be accordinly harsh - and a more lax scoring was used when the subject was following a more complex shoreline. In the latter case only touching the shoreline or falling off the kerb would be counted as errors.

As well as this error-rate scoring which was necessarily crude and very subjective, every walk which the subjects made was timed and speeds of walking ascertained. This provided a more objective measure of performance.

As stated above, although these detailed records were made, they provide very little information presented as raw data. There are not enough data from which to draw learning curves and they really only provided rough confirmation of the experimenter's subjective assessment of whether or not a subject was competent at a particular skill or subskill. Thus, these data are not given here, though the more meaningful estimates of number of days to competence at a particular skill are given.

2.21 Self-rated anxiety levels.

At certain points during the training the subjects were asked to rate themselves for feelings of anxiety, to try to give the experimenter some idea of the variation in performance with anxiety levels. The procedure for self-rating was to tell the subject to imagine a scale from 0 to 100 which represented increasing levels of anxiety from complete calm to the most anxiety producing situations they could conceive of. At points during the training - usually at the start of a new skill such as learning to walk round a residential area and later after learning this skill - they were asked where their feelings of anxiety while performing the skill lay on the scale. This

measure of anxiety[7] gave some surprisingly consistent indications of the effect of anxiety on some aspects of Sonic Aid use.

2.22 Final Assessment.

The major scoring and assessing exercise came at the end of the training on all 24 lessons:

2.23 Proficiency in clear path/shoreline following.

This was assessed by timing and noting the error rates of all the subjects over a known route of $\frac{2}{3}$ mile (over which they had travelled with the Aid 7 times before) and an unknown route of $\frac{1}{3}$ mile (over which they had been led once, without the Aid, by a sighted guide who gave end of block directions.) The subjects were also filmed over these routes at the same time as their assessment was being carried out. Thus, a complete record of their final capabilities was taken. This was compared with self-taught Aid users[1] and Long Cane travellers[6].

2.24 Proficiency in identifying objects at a distance.

For this assessment a battery of 35 test objects was compiled which the subjects were required to investigate with the Aid and identify either by describing all the properties (dimensions, texture etc.) of the object or by naming it. This test battery was devised by the author and such a battery had not been suggested previously. It is hoped that the battery or an adaptation of it may prove to be useful in future assessments of trainees.

The objects to be investigated were, in the main, in places

which the subjects had not visited before. If a known area had to be used, precautions were always taken to disorientate the subjects so that they did not recognise it. The objects were selected in such a way that the seven features which the trainees had been taught to identify - viz. width, length, texture, presence or absence of overhangs, steps, gaps and corners - were covered many times over. The objects were then listed and classified according to their features which were broken down in the following way:

i	Height	- (a) High (H)	ht > 6'
		(b) Medium (M)	ht 3' - 6'
		(c) Low (L)	ht < 3'
ii	Width	- (a) Boundary (B)	Edges undetectable on Aid.
		(b) Wide (W)	1' - 5' (approx)
		(c) Thin (T)	< 1'
iii	Texture	- (a) Rough (R)	(and if possible what sort of rough texture.)
		(b) Smooth (S)	
iv	Overhang	-	O
v	Corner	-	C
vi	Steps	-	St
vii	Gap(s)	-	G

These features were totalled and the number of times each appears is shown in Table I. Thus a telegraph pole would have the features of High (H) and Thin (T). A lapped fence with

TABLE I

No of appearances of each feature in the test battery

(i) Height		(a) H = 16	)	
			)	
		(b) M = 10	)	Total 34.
			)	
		(c) L = 8	)	
(ii) Width	-	(a) B = 13	)	
			)	
		(b) W = 12	)	Total 32.
			)	
		(c) T = 7	)	
(iii) Texture	-	(a) R = 11	)	
			)	Total 25.
		(b) S = 14	)	
(iv) Overhangs	-	O = 9		
(v) Corners	-	C = 3		
(vi) Steps	-	St = 1		
(vii) Gaps	-	G = 1		

TABLE II

Object Description.	Ht	Width	Texture	O/ Hang	Corner	Gap
Bollard	L	T	-	-	-	-
Bush - medium	M	W	R	-	-	-
Chair	L	W	S	-	-	-
Corner of wall	H	-	S	-	C	-
Corner of House	H	-	S	-	C	-
Corner of Eaves	H	-	S	O	C	-
Electrical mains box	L	W	S	-	-	-
Eaves of building	H	B	S	O	-	-
Outside steps	-	W	-	-	-	St
Gateway (open) in railings	M	W	R	-	-	G
Hedge - high	H	B	R	-	-	-
Hedge - low	L	B	R	-	-	-
Lapped fence with overhanging trees	H	B	R	O	-	-
Lamp post - high	H	T	-	-	-	-
Lamp post - low	H	T	-	O	-	-
Lapped fence - medium	M	B	R	-	-	-
Litter bin	L	T	-	-	-	-
Mesh fence	M	B	R	-	-	-
Pillar box	M	W	S	-	-	-
Packing case	M	W	S	-	-	-
Road sign	H	T	-	O	-	-
Sign post - low	L	W	S	-	-	-
Sign post - medium	M	W	S	-	-	-
Side of house	H	B	S	-	-	-
Railings	M	B	R	-	-	-
Tree	H	T	-	O	-	-
Tree - wide	H	W	R	O	-	-
Telephone Kiosk	H	W	R	-	-	-
Telegraph post	H	T	-	-	-	-
Wall - low	L	B	S	-	-	-
Wall - medium	M	B	S	-	-	-
Wall - high with top	H	B	S	O	-	-
Upkerb	L	B	-	-	-	-
Car	M	W	-	-	-	-
Bus shelter	H	B	R	O	-	-

Complete list of objects in the Test Battery with their codified descriptions

trees behind it and overhanging the pavement would have features Rough (R) Boundary (B) High (H) and with Overhang (O).

The complete list of test objects is shown in Table II.

As the investigations were carried out in street situations for the main part it was difficult to state accurately how far an object was away from the Aid. However, the distance was usually about 4', with a few objects at about 3' and a few at about 5'. These distances depended on the layout of the objects, normally. Also, a variety of noise levels (from traffic etc.) accompanied the investigations so that some were carried out in quiet situations and others in busy main roads. The noisy surroundings increased the investigation time as the subjects often had to wait a few seconds until a particularly noisy convoy of traffic had passed.

Scoring the identifications

If a subject identified by name an object (if he said "bus shelter") and was correct, 2 points were awarded. Also, if he correctly identified all the features separately, 2 points were awarded. 1 point was awarded if one of the features was wrong and 0 points if any more errors were made. Each subjects score was then compared with the maxima and attempts were made to establish the weak areas of each subjects investigations.

The subjects were also timed on each investigation and the number of sweeps necessary to identify an object was recorded.

3. Results.

Results of the continuous assessment.

3.1 Assessments of the training times for specifiable skills

The stages which can be picked out from the training as clear landmarks in time are listed in Table III. After each stage the times for each subject from the beginning of the existing (Manual) course is given, together with the average time to reach this stage, irrespective of when during the course the skill was first attempted. It should be understood that the only activity with which the subject was concerned was the one stated. Thus, if he is described as having the ability to detect and negotiate a moving pedestrian while he himself is moving, this implies that he is not at the same time concentrating on following the shoreline, but just walking a straight line in an open space. It can be seen from Table III that with the present Manual it takes approximately 22 days (12 training hours) for the correct judgement of distances up to 9'; 68 days (37 training hours) for discrimination of various textured surfaces; 80 days (42 training hours) to follow any shoreline while scanning; and 90 days (48 training hours) to investigate, recognise and negotiate most objects and obstacles.

TABLE III

This table shows the number of training days from the beginning of the course needed to reach specific stages of performance - i.e. the completion of specific skills

SKILL	NUMBER OF DAYS				
	H.S.	J.A.	H.K.	D.G.	Av.
dgement of 3 relative distances - to 3'(the danger or Halt signal) - 6' and over 6' from an object	2	4	5	3	3
cognition of, and stopping at, Halt	6	6	6	11	7
llowing a plain shoreline with the d fixed and monitoring shoreline ntinuously	10	14	19	15	14
epping aside for pedestrian - both edestrian and learner mobile	9	20	25	16	17
tting through a gap 6" wider then eir body	25	25	22	17	22
rrectly judging and naming distances 1,3,5,7,9 feet	25	25	22	18	22
llowing any shoreline with Aid fixed nd monitoring shoreline continuously	41	40	46	45	43
lking and scanning with dominant nd along smooth shoreline	51	47	47	53	49
lking and scanning with both hands ver a small residential route (c200yd)	59	49	49	61	54
scrimination of railings/pailings pped fencing, hedges and smooth e.g. brick) surfaces.	78	67	62	66	68
mpetent walk/scan with either hand long any shoreline even if very degraded	84	72	72	92	80
oid unexpected low obstacles	95	not learned	85	73	84
nvestigate and name or describe objects	97	94	85	85	90
egotiate expected downkerbs with Aid	101	not learned	85	74	87
lk known or unknown residential area f $\frac{2}{3}$ mile, scanning, avoiding pedestrians nd obstacles, carrying out upkerb/downkerb rill	91	84	91	92	90
otal no. of days training (including on-training days)	101	96	96	92	96
stimated total no. of hours training	54	51	51	49	50

However, not every training session dealt with all of these skills, and also some of the skills were not started until some time through the training course - e.g. the investigations did not start until the last quarter of the course. Thus, Table IV has been constructed to give some indication of the length of time from the beginning of a particular skill to its completion. The four major skills have been considered for Table IV - viz. distance judgement, clear path shoreline travel, surface discrimination and object identification. There is some difficulty of interpretation here in that the main training on one of these skills could last for the whole of the second half of the course, for instance, but make use of a subskill which was learned much earlier in the course. Such occasions are fairly rare, however, and allowances are made for them. Also in Table IV an estimate of the number of training hours needed for each major skill is given. It is assessed on the basis that roughly one-third of each training session during the number of days stated was allowed for each skill.

From Table IV it can be seen that the total time taken on learning the four major skills in the course is approximately 22 hours. From Table III, however, it can be seen that the complete course took an average total of 50 hours. The extra 28 hours were taken up mainly with extended low level exercises and listening to tape recordings, the object of which was to prepare the learner for training in the major skills.

3.2 Subjects self-rated anxiety levels.

Using the method described in paragraph 2.21 the subjects, at points during training gave a value between 0 and 100 which corresponded to their anxiety feelings. These values, together with the number of days after beginning training and the situations involved are given in Table V.

3.3 Number of days for each lesson.

The number of days training for each lesson remained surprisingly constant for all the subjects. On the average, and there were few deviations, each lesson took 4 training days (including week-end time, i.e. actual training sessions were about 3 per lesson) or about 2 hours training. Naturally, some of the subjects found some exercises more difficult than the rest, and these were continued even though a new lesson had been started. Thus, if a subject found difficulty with an investigation lesson, this did not prevent him from going ahead with scanning parts of the lessons etc, and a subject might be learning one lesson while still continuing exercises with which he was finding difficulty from 2 lessons previous.

Results of Final assessment.

3.4 Clear path travel.

The times of the subjects over the known route I and the unknown route II are shown in Table VI. Also shown there for comparison purposes are the times over the same routes of

Table V.

Subjects self-rated anxiety scores (o being complete calm and 100 being acute anxiety) at stages during the course.

Stage in training or skill being acquired	No.of days from beginning of course (average.)	Subject's Anxiety Rating			
		H.S.	J.A.	H.K.	D.G.
Walking indoors with only white cane protection (basic skills pretraining) Over about 4 trials	0	25	30	25	50
Following any shore-line with Aid fixed and monitoring shore-line continuously. Over about 5 trials	43	35	25	30	60
Walking & scanning with both hands over a small residential route (c 200 yds.) Over about 6 trials	54	45	30	30	60
Walking a known residential route of ⅓ mile carrying out all clear path techniques unguided. One trial.	90	50	30	30	70
Walking an unknown residential route of ⅓ mile carrying out clear path techniques unguided. One trial.	90	60	50	50	90

Table VI.

This table shows times in minutes and seconds over Routes I and II for trained sonic aid users, long cane users with 4 weeks training and self-taught sonic aid users. Route I is about ¾ mile long and Route II is about ½ mile long.

	Present subjects					long cane users (AV of 24.)	self taught aid user (AV of 2.)
	H.S.	J.A.	H.K.	D.G.	Av.		
Route I (known)	17.40	15.00	13.35	18.30	16.11	22.24	13.27
Route II (unknown)	11.50	8.15	8.50	14.30	10.51	13.05	7.37

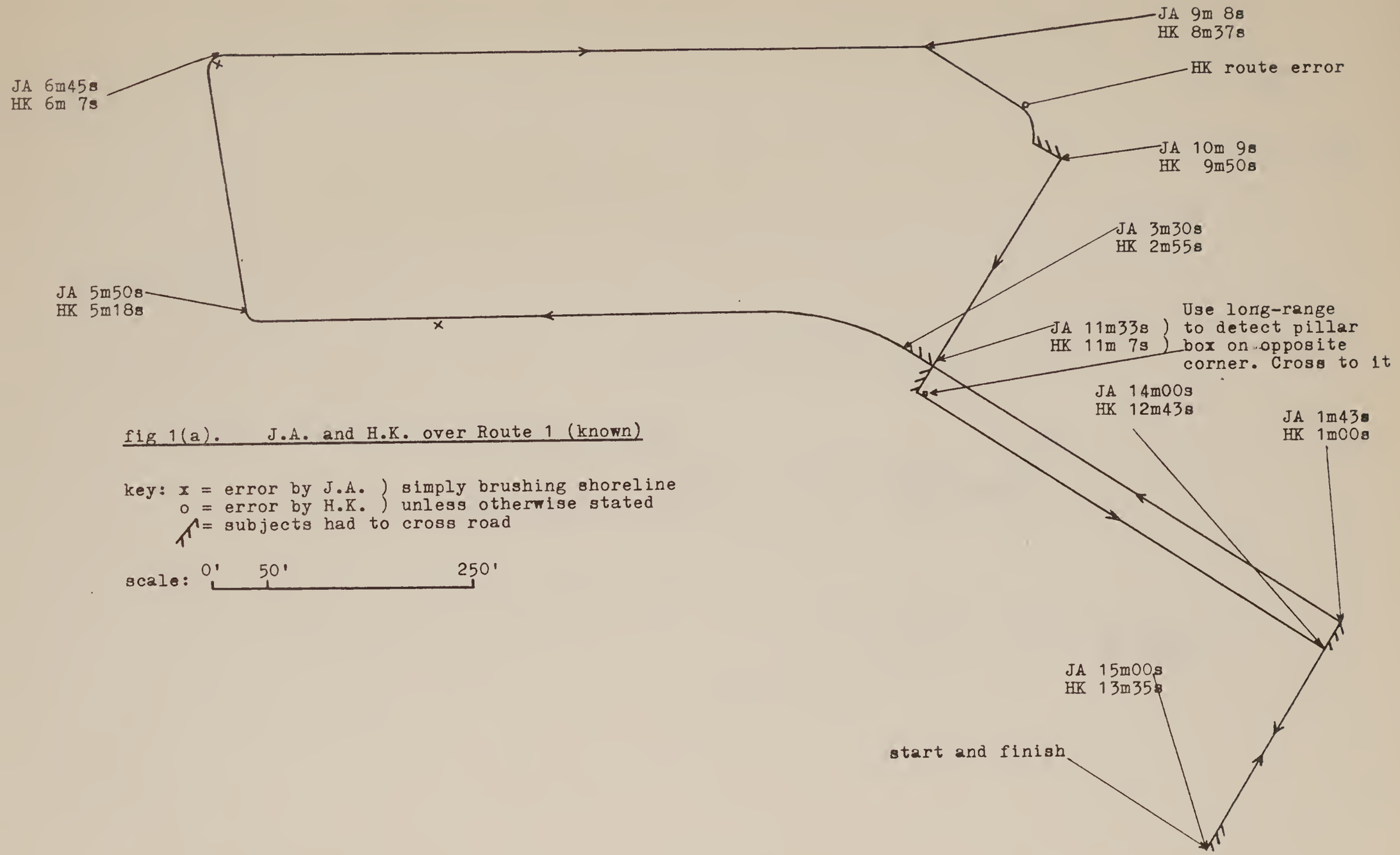

fig 1(a). J.A. and H.K. over Route 1 (known)

key: x = error by J.A.) simply brushing shoreline
o = error by H.K.) unless otherwise stated
= subjects had to cross road

scale: 0' 50' 250'

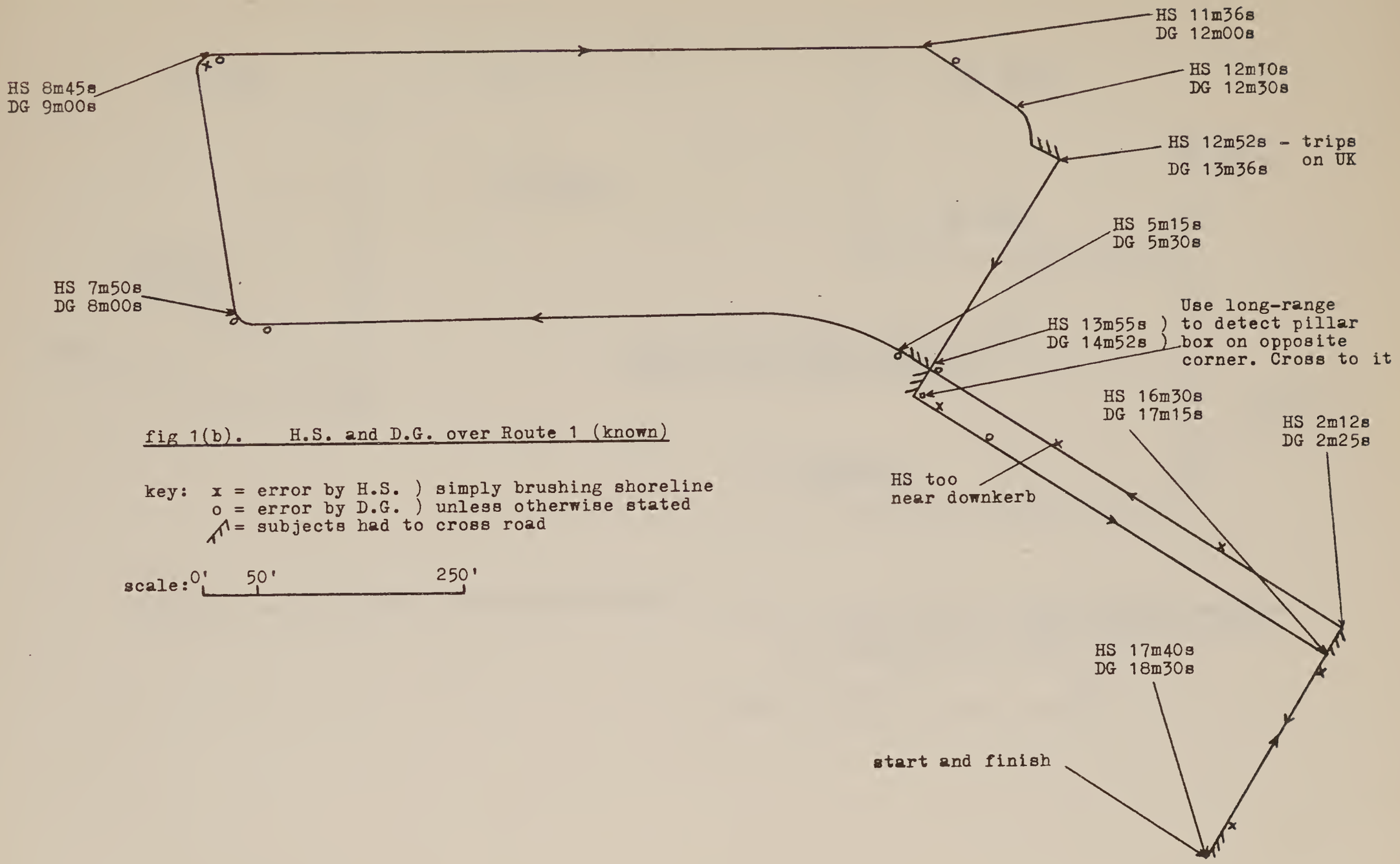

fig 1(b). H.S. and D.G. over Route 1 (known)

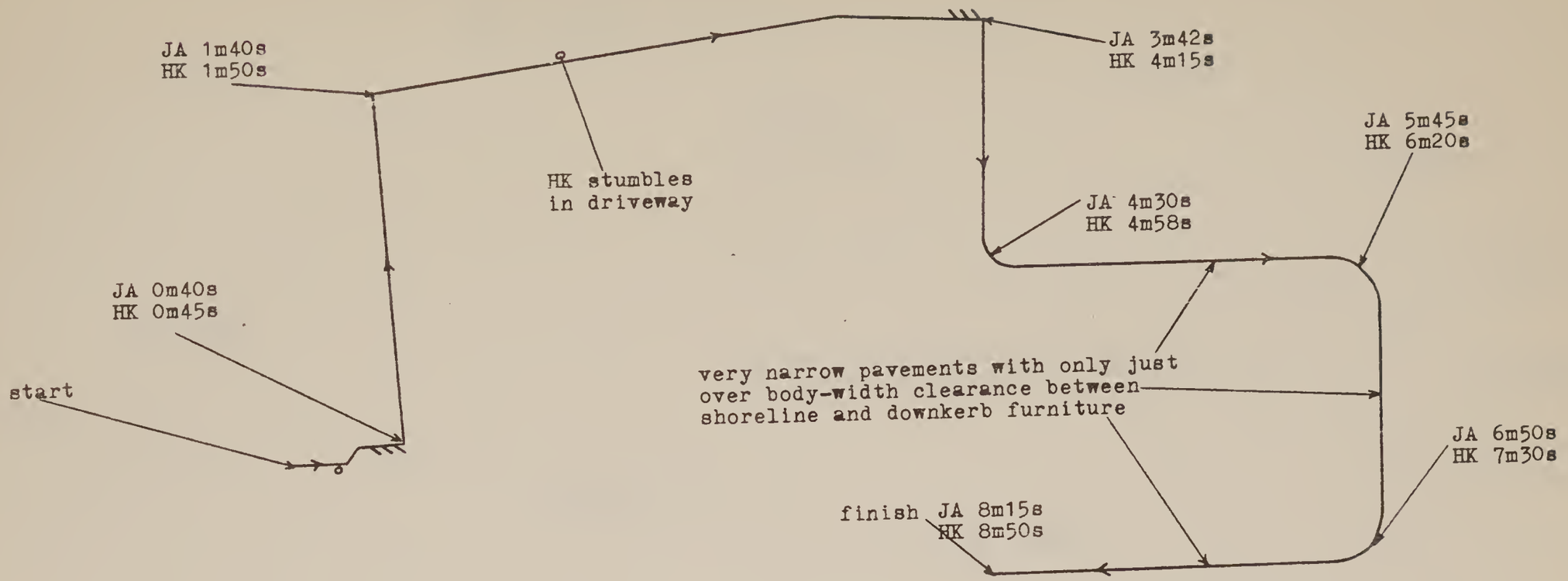

fig 2(a). J.A. and H.K. over Route 2 (unknown)

key: x = error by J.A.) simply brushing shoreline
o = error by H.K.) unless otherwise stated
= subjects had to cross road

scale: 0' 50' 250'

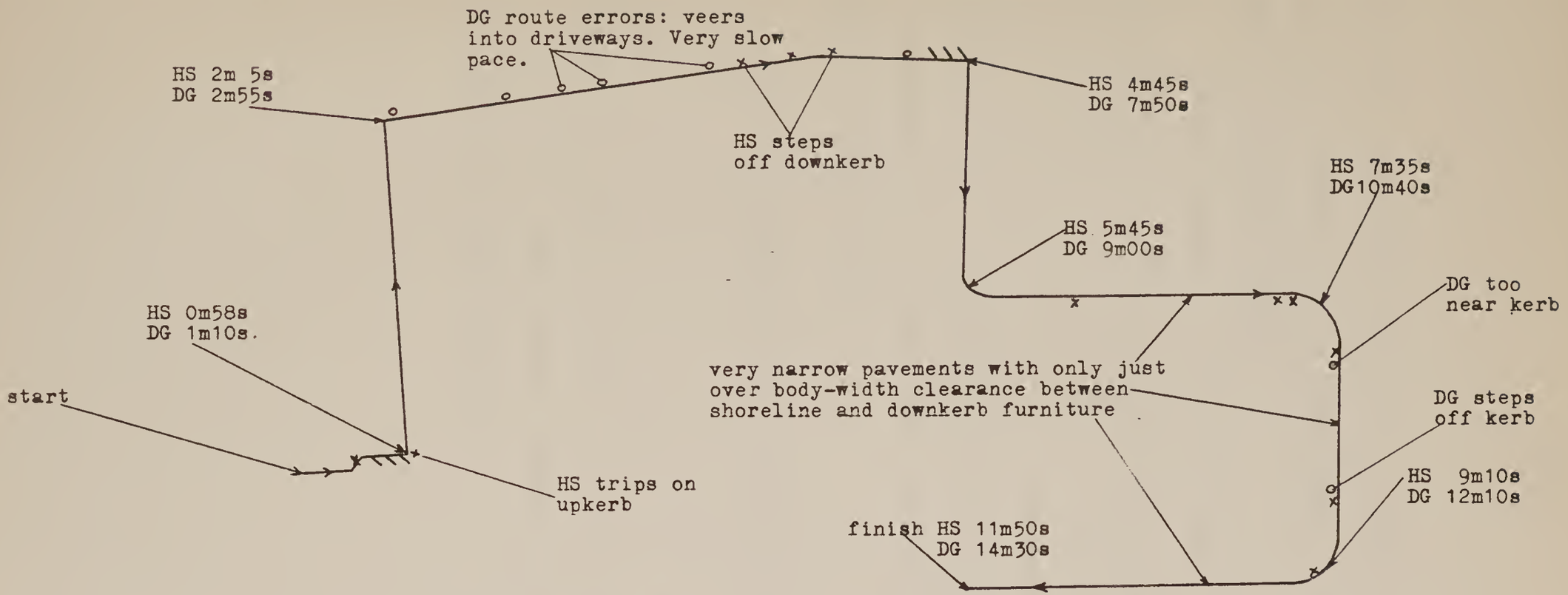

fig 2(b). H.S. and D.G. over Route 2 (unknown)

key: x = error by H.S.) simply brushing shoreline
o = error by D.G.) unless otherwise stated
= subjects had to cross road

scale: 0' 50' 250'

Long Cane subjects after 4 calendar weeks training (J. Pare, personal communication 1969)[6] and of two self-taught Sonic Aid users (Armstrong 1969)[1].

Illustrations of the two routes are also given (Figs. 1a and b and 2a and b.) The subjects for these illustrations were split into 2 pairs - J.A. and H.K. in one and H.S. and D.G. in the other - for ease of entry of information on the illustration. In Figs 1 and 2 collisions with shoreline are marked (there was no incidence of falling off the kerb throughout) and times at end of blocks given.

3.5 Investigation/Identification.

The results of the investigations of the 35 test objects (Table II) are shown in Table VII. The objects varied along the dimensions shown in Table I and the abbreviations have been used in Table VII. The times, number of sweeps, and accuracy scores are shown for the objects.

Table VII.

	Measure	Subject H.S.	J.A.	H.K.	D.G.
1	Average time per investigation (secs)	27.5	27.1	12.0	20.7
2	Average no. of investigation sweeps per object	2.5	2.9	1.5	2.5
3	Score on occuracy of identification (%)	69%	61%	83%	47%
4	% H correctly detected	100%	94%	100%	100%
5	% M " "	100%	80%	70%	80%
6	% L " "	100%	100%	100%	87%
7	% B " "	92%	100%	100%	92%
8	% W " "	92%	92%	92%	50%
9	% T " "	86%	86%	100%	57%
10	% R " "	91%	64%	91%	91%
11	% S " "	71%	64%	71%	21%
12	% O " "	100%	100%	67%	89%
13	% C " "	33%	33%	100%	67%
14	% St " "	100%	100%	100%	100%
15	% G " "	100%	100%	100%	100%
16	% Heights correct (total)	100%	91%	91%	91%
17	% Widths correct (total)	91%	94%	97%	69%
18	% Textures correct (total)	80%	64%	80%	52%

Performance on Investigation Skills

N.B. by "identification" is meant either naming the object or describing correctly all of its properties in terms of the 7 variables given.

4. Discussion.

Distance Judgment.

4.1 Actual performance of the skill (see 2.11)

This skill, which involved the ability to identify correctly the distance of the Aid from a reflecting surface as 1,3,5,7, or 9 feet was learned very quickly by the subjects (22 days - see Table IV) and could probably have been learned even more quickly had the training schedule been less spread out. The subjects complained that the exercises took them too slowly towards the final skill and that many of them were redundant.

4.2 Tape recorded examples and tests (see 2. 12)

These comprised a series of some 37 sets of examples and tests - one or two of which accompanied each lesson from lesson 3. The comments of the subjects, however, indicated throughout that they were very unhappy with the tape recordings. J.A. and H.S. were adamant that the tapes served only to confuse them and that they would have felt better without them - at least as far as the tests were concerned. The main problem area was the very long series of Pitch - Distance tests designed to make the trainee learn the pitches associated with the distances of

1,3,5,7, and 9 feet. These tests were included in every lesson for the first three-quarters of the course - the last quarter of pitch distance tapes being tests of knowledge of distances nearer or farther than 3' (the "danger" or halt signal.) It seems then, that a great deal of importance was attached to these particular exercises in writing the Manual. However, as Table IV suggests this was a very easy task which was learned in about 3 weeks, or 15 sessions, only the last 3 or 4 of which were intensive training on 1,3,5,7, and 9 feet. The preceding lessons were on knowledge of the halt signal and the 6' signal. It seems from this investigation that the importance and difficulty of exercises in pitch-distance knowledge may have been overemphasised- for this sample of subjects at least. The view here, however, is that the tape recordings could be abbreviated markedly, and used merely as an example of the general sort of thing the user could expect to hear. This might give more time to bring the higher level skills forward in the course and concentrate on them more.

Clear Path Travel.

4.3 Obstacle avoidance (see 2.13)

The subjects all learned very competently the vigilance task of obstacle detection and avoidance. After an average of 90 days from the beginning of the course, or a total of about 56 days on the actual skill itself, the subjects could all safely follow a complicated residential area route with no

help from a guide.

The techniques recommended in the Manual for avoiding obstacles beginning at ground level and ending higher than the Aid position included a fast scan of short amplitude which monitored the obstacle as it was being passed. This was to give an idea of its depth. The 4 subjects performed this technique, but later tended to omit it in favour of keeping to the usual scan as they were passing the obstacle. They did not find the fast scan particularly useful unless they needed to have an accurate knowledge of the extent of the obstacle, which was rare on simple route travelling exercises. Any extensive knowledge of an obstacle could be adequately performed with the investigations.

Low obstacles presented more of a problem especially to J.A. who never successfully learned to detect unexpected ones, though he could negotiate expected obstacles, such as upkerbs very well. He also never fully appreciated the detection of expected downkerbs. The other subjects also found the detection of expected downkerbs by far the hardest skill and even at the end of the course, although most situations of this sort could be dealt with, it was felt that the subjects all needed much more practice with these skills before they could be 100% accurate. It would probably be an advantage if the low obstacle exercises were moved forward in the Manual so that they could be practised for a longer period.

4.4 Negotiating a gap between two obstacles. (see 2. 14)

Occasionaly, during the scanning and walking two obstacles would be detected - one on the shoreline and one on the kerb side - with only a narrow space between them. The width of the space was assessed with an investigation scan, and after the subjects had lined themselves up with the middle of the gap, they went through it using a fixed Aid (as in the Beam Width (2.14) exercises) pointing always at the middle of the gap. If one of the obstacles reappeared in the beam, it meant that they had veered towards it, and they then realigned themselves with the middle of the gap. This was the only time the Beam Width (2.14 exercises) skill were used, but in these circumstances they proved to be very useful.

4.5 Scanning techniques (see 2.16)

The continuous scanning technique which was taught to the subjects instead of the discrete scan intended by the Manual seemed to be eminently satisfactory. The problem with a discrete scan would be that since the positions of the Aid - right, centre, left, centre, right etc. - must be synchronised with each bleep in turn, as well as the foot movements, or with each two bleeps in turn, the user's walking speed is restricted to two rigid values - either one pace every two bleeps or one every four bleeps. Such a rate of progress would be very difficult to carry on for any length of time, and one which allows for small variations in pace, such as with a continuous scan would probably be much easier to use. As it was, this latter type of scan seemed very suitable for the

present subjects.

Except in the early stages, the possible problem with a continuous scan - that an object dead ahead might be missed if a bleep did not coincide with it - was not encountered. Subjects were able to detect any obstacles to their sides or in front after about 10 sessions of travelling in street situations. Even during these 10 or so sessions only occasional and negligible collisions (say with a shoulder or elbow brushing the obstacle) were made.

It seems then that the continuous scan is a perfectly viable one for trainees to learn on the Aid. And it has the added advantage that speeds can be varied at will rather than being restricted to only 2.

4.6 Use of either hand for scanning/shoreline following

It seemed better in terms of errors and speed for the subjects to change the Aid from one hand to the other if necessary so as to keep the Aid hand nearer the shoreline. If the Aid was used on the kerb side of the body the reflected echoes from the shoreline were very difficult to hear and interpret. The transfer of skill from the dominant hand, with which scanning is first learned, to the other hand was undertaken very quickly with the 4 subjects (within about 3 sessions.)

4.7 Pavement position

The subjects usually had to travel at a fixed distance from the shoreline (about 3 feet) rather than at mid-pavement. Usually, within a tolerable range, these two distances

coincided, but if the pavement was very wide the distance from the shoreline could not be appreciably increased. If it was, the signals became too complex for interpretation. However, if the pavement narrowed markedly, the subjects could travel nearer to the shoreline.

The mid pavement position is usually the safest one for a blind traveller, as obstacles tend to occur on the kerb or the shoreline, and so optimally he should keep to mid pavement. However, this is usually considered as being a wide stretch of the middle pavement, and the Sonic Aid position generally fell within it. Thus, this position does not seem to present any problem for the Aid user.

4.8 Correction for departure from straight line (straight line travel.)

The accuracy of travelling in a straight line at a fixed distance from the shoreline was very high for H.S. H.K. and J.A. The fourth subject, D.G. was not so accurate however. The main reason for thiswas that the first 3 subjects could travel much more quickly than D.G. and this made their straight line travelling much easier (B.J. Cratty 1966)[2] They were also usually able to correct any veering by veering the other way while still mobile. D.G. however, if he found the pattern of shoreline pitch signals changing, would stop and realign himself with the shoreline and start again. Since the most difficult part of following a route seemed to be the initial starting in a straight line along a

shoreline this meant that D.G. tended to zigzag his way along a shoreline in fits and starts. He was always highly anxious when performing such tasks and thus very stiff and physically incapable of either increasing his speed or by veering slightly while mobile, make his walking into a continuous whole. This technique of correction by veering seemed to be a very useful one for the other 3 subjects, however, and the veers eventually became so small, in order to correct the straight line, that they became almost inperceptible. The correction seemed to be continuous and instantaneous - much like steering a car. This veering technique was not mentioned in the Manual, however, and it would probably provide a useful addition to the notes on the higher level skills.

4.9 Comparison with other means of mobility

Table VI indicates that the Sonic Aid compares very favourably with the Long Cane as a mobility aid. Although there is no information available on error rate comparisons, it would be reasonable to assume that both sets of subjects compared about equally on incidence of errors. The times over the routes can thus be meaningfully compared, and it can be seen that the Sonic Aid users are travelling slightly faster than the Long Cane users.

It would seem then that the Sonic Aid has a place with the Long Cane as a primary mobility aid. The training times are as yet not so short as for the Long Cane (about 2 months for the clear path skills as opposed to 1 month on the Long Cane,) but

suggestions will be made as to how this time could be shortened (6.2.)

Environment Sensing.

4.10 Surface discriminations (see 2.15)

It proved to be a very easy task indeed for the subjects to learn surface discriminations (about 14 days or 2½ training hours, (see Table IV). Rough and smooth surfaces were readily distinguished, and within the "rough" category such distinctions as hedge, lapped fence, railings and corrugations could be detected.

The tape recorded examples seemed to be helpful for this particular task. There were only 4 recordings in the surface series, which seemed to be about the right length as far as could be judged from the subjects reactions - which could vary from interest in the tapes to complete boredom with them. In this instance, however, the subjects made such comments while actually performing the task as "This sounds like the recording of the hedge" and so correctly identified surfaces.

4.11 Investigation technique (see 2.17)

The horizontal-vertical sweep which was used by the trainees for investigations and identifications seemed to be an economical and highly informative procedure (Table VII). Economical in that not every part of the object needed to be sampled; and informative in that an overall impression of the object could be obtained

without becoming unnecessarily involved - at least unless one wanted to - in very minor details. Thus, eventually sound patterns were identified by naming the object in a large number of cases (e.g. where the object was a commonly occuring one) rather than by discribing the sum of its details. With a hitherto unencountered object of course, the latter method had to be resorted to.

In general, then, the investigation technique soon provided the subjects with recognizable sound patterns from which they could identify a large range of objects by name.

4.12 Free use of the Aid (see 2.18)

As only one Aid was available for the use of the 4 subjects, they could not be allowed to use it in their own time. Thus, the only free use of the Aid - i.e. to do what they want outside the limits of the day's lesson - was in the presence of the experimenter, say on the way to and from a teaching area etc. The free use of the Aid which the Manual recommends is probably a very important part of the training, and its relative neglect was of considerable concern. However, the subjects ultimately became proficient despite this lack of free use which makes their proficiency the more significant.

The free use of the Aid would however, be of the greatest importance if any trainee was particularly interested in using the Aid as a detailed environment sensor, rather than as a clear path indicator alone. The problem with some of the subjects

here was that they were very incurious people who were not particularly anxious to pick out details of their environments so much as to be able to travel from A to B safely. A considerable amount of exhortation had to be given to some subjects in order to make them explore more. This was probably due to their being blindfolded sighted subjects. The motivation to explore with the Aid was not very high as they knew that they could see similar environments when the blindfold was off. However, motivation was given in other ways such as trying to make investigations as enjoyable as possible. And again, even without the motivation of a blind person, the final performance was still high on investigations.

4.13 Tape Recordings for the investigations.

These tapes comprised examples of the sounds to be expected when carrying out investigations and also tests, consisting of sound patterns from which the trainee had to identify the object under investigation. As with the distance judgment tapes, the impression gained was that the examples were useful in moderation, but the tests were often confusing for the subjects.

One very important point which is relevant here is the fact that in the learning of audio-motor skills it is important to the subject to be able to correlate exactly his motor activity (e.g. the arm movements and position of the Aid in the Investigation sweep) with the auditory input (the resulting sounds from the Aid). This important aspect was overlooked in the Cleveland

studies on better hearing (Norton 1960)[5] where artificial auditory input was given to subjects. The fact that they had no bodily movements to correlate with the inputs they were receiving made this auditory input very difficult to interpret. Similarly, with the present subjects it appeared, mainly from the subjects reports, that they needed to know the arm positions, where the Aid was pointing, the length and speed (which was bound to vary slightly) of the sweep etc., as well as the auditory input before they could make successful identifications - especially on complex objects. It would appear that the tape recordings for the investigations could be reduced without loss of performance on the skill.

4.14 The Investigation Test Battery (see 2.25)

This battery proved to be very informative indeed in assessing the performance of the subjects on investigations. Not only did it allow the experimenter to give a percentage accuracy of identification, but also to determine areas of weakness in any subjects performance. Thus, a subject might be excellent in all aspects of investigation except the judgment of widths: any such failing could be determined by the test battery and special instruction given in that area.

It is probable that the battery could be reformulated, or modified for individual uses. But the concept of codifying many different objects in this way and studying any areas of weakness seems to be a very useful one.

4.15 Assessments of the Investigations (see Table VII)

All of the subjects learned the investigations well, though by far the best was H.K. She took only half as long as the others to identify an object, and needed only half as many investigations (Table VII items 1-2). Although D.G. had learned the skill, as well as he could in the time of the course, in a shorter time than H.K. the aptitude of the latter and rate of progress was much greater - as was her final performance,

(i) Judgment of middle heights (3' - 6') Table VII item 5. These were sometimes reported as being higher than they were, and this was probably because a reflection from the edge of the beam could be heard even when the torch was pointing above the object. Usually the amount of error was only of the order of 1 - 2 feet but enough to be scored as an error.

(ii) Judgment of wide objects - Table VII item 8. These were sometimes classified as thin and sometimes as boundaries. D.G. was especially poor with wide objects and often classified them as boundaries - again probably because he could still hear echoes from the edge of the beam even though he was pointing the Aid to one side of the object. More practice would be needed to learn with 100% accuracy the difference between the return from the object in the direct beam of the Aid and an echo from the edge of the beam.

(iii) Judging difference between thin and wide - Table VII items 8 and 9. This was especially difficult for the female subjects who seemed to have very little idea of what various lengths looked

like. Thus, it is highly likely that although the subjects actually had a very accurate idea of the width of obstacles, they had difficulty in attaching an actual figure to the measurement. The criteria of <1' and 1' - 5' were fairly rigidly adhered to in the tests, and perhaps somewhat more flexible criteria would probably put a more favourable light on the subjects judgments.

(iv) The errors in the texture judgments - Table VII items 10 and 11. These were almost entirely errors of omission. The subjects had a great deal to think about when reporting what they had investigated, and texture, especially smooth textures, were almost certainly not mentioned because the subjects thought there was nothing out of the ordinary to remark upon, i.e. they probably realised an object was smooth but felt it was too obvious to say so. In general, however, texture judgment was excellent. And the figures in Table VII do not do justice to the accuracies involved. Rough textured objects were, on the majority of occasions, correctly identified as railings, lapped fencing, hedges, and even bark of a tree.

(v) Corners, Table VII items 13. These probably presented the greatest difficulty of all(though not to H.K.) These were invariably identified - where the identification was incorrect - as wide objects. The difference between the corner of a building and a wide object is very fine indeed, and the error is an understandable one. J.A. however, was adamant that he could <u>never</u> learn the difference

and that it was a matter of guesswork if he identified a corner.

Although these problem areas existed, they were very small in extent, and would probably have disappeared with more practice. As it was, the overall performance was very impressive and at the time of testing (after about 90 days of overall training or 33 days investigation training) the subjects techniques and approach to investigation were very accomplished.

4.16 Long Range Investigations

These were not used very much at all. Resolution in long range is not very good and the only places in which it was useful were at certain road crossing points where there was, say, a pillar box on the other side of the road. This gave quite a distinct signal. Elsewhere the long range was simply unnecessary.

4.17 Self-Rated anxiety scores (see 2.21 and 3.2)

Comparison of the overall anxiety levels of the 4 subjects during training (Table V) shows clearly that the order of the subjects, in increasing levels of anxiety was H.K., J.A., H.S., D.G. H.K., and J.A were both relaxed and confident travellers while H.S. was a little less self confident, and slightly more tense, and D.G. was chronically stiff, tense, and highly anxious. The film taken of these subjects bears out the self-ratings very well - from the almost nonchalant H.K. to the rigid and robot-like progress of D.G.

The most interesting finding, however, was the fact that the

order of the subjects with respect to their anxiety ratings appears to correlate very highly with their order with respect to performance on the various skills. Quite obviously direct comparisons between the 4 subjects are difficult to make as their scales may not have had exactly the same reference points - i.e. acute anxiety may have meant slightly different things to different subjects. But the ratings are sufficiently different for D.G. and the two best subjects J.A. - H.K. to suggest that D.G. was very much more anxious than the latter two. It would seem probable that the high degree of maladaptive muscular tension generated by his high anxiety level during training may have had a deleterious effect on his acquisition and subsequent performance of the complex motor skills involved. And similarly, though to a much lesser extent with H.S.

The present results should only be considered as trends, however, and would not be statistically significant owing to the small number of subjects, and the difficulty involved in quantifying many of the subjects' performances. However, it would seem that there is sufficient indication in these results to justify further research into the problems of anxiety in complex motor skill aquisition, and possibly into methods of controlling such anxiety.

4.18 External Noise

There is no doubt that very noisy environments, such as some of the main road areas which some of the subjects used, have a detrimental effect on performance with the Aid. H.S., H.K., and

D.G. tended to slow down (with increasing frequency in the order given) when heavy lorries etc. were passing them, and J.A. was completely unable to carry on if there was a great deal of traffic noise. J.A. in fact was the most disturbed by outside noise, and reported that in order to cope with it he had to have the Aid on full volume - the result of which was that he had an auditory aftereffect for a few hours after the session

Often, it was noticeable that the subjects moved in closer to the shoreline if there was much noise, as this gave them a less diffuse return of echo from the shoreline. However, in the main the subjects were able to perform in noisy conditions, although they walked more slowly and investigated more slowly. (cf Leonard & Carpenter 1964.)[4]

5. Summary of the Evaluation.

In this section an attempt will be made to answer the questions and problems outlined in the Section on Aims of the Present Evaluation:

5.1 The Role of the Sonic Aid in relation to other forms of mobility Aid.

The evidence presented in this report (3.4, 4.9) suggests that the Sonic Aid has a place with the Long Cane and Guide Dog as a primary mobility device. It has the disadvantage in clear path travel that steps down, especially when unexpected, are extremely difficult to detect (4.3). Downkerbs at end of blocks however, are easy to detect by inference from the dieappearance of of a shoreline. The major advantages of the Aid are (a) that a blind person need not necessarily be marked as blind, as he would if he used the Long Cane and (b) a blind traveller can investigate and identify objects in his environment without necessarily touching them (3.5, 4.10, 4.11.)

5.2 Utilisation of the full potentialities of the Sonic Aid language.

The present Manual is probably the most detailed training system possible for use with the Aid. It provides for use of the full range of the Aid's capabilities. The 4 subjects used here were all trained under this system and it can quite confidently be said that all of the expectations of the authors of the Manual were realized in these subjects. They were all capable of interpreting and using information from a moving Aid - information which involved an infinitely changing patter of sound from the Aid (Table VII.)

5.3 Establishing of training times.

It is now possible to enumerate the various major stages in Sonic Aid training (Table III) and to give an indication of the length of time required to reach these stages, using the Manual (Table III and IV). Until the present time there has been no means of estimating the length of the total course, which has meant that some potential trainees may have been disinclined to learn a course which had not yet been proved. It is hoped that the estimates given in this report will ssrve to give trainers and trainees some indication of the length of time required to learn to use the Aid.

5.4 Provision of simplified Manuals for specific purposes

The evaluation has provided a good deal of information regarding the efficacy or redundancy of the exercises described in the Manual. On the basis of this knowledge, it has been possible

to construct two short courses from the exercises in the main Manual designed for clear path travel and environment sensing. These are described, with reference to Manual exercises, in Appendix A. & B.

5.5 Examining the role of sighted friend as Instructor

The experience of the experimenter, who was not a trained instructor, but an experimental psychologist primarily, has been useful in developing an opinion regarding the preferability of trained instructors as against sighted friends as guides. The opinion is strengthened by the obvious practical implication that a trained instructor would be acquainted with the underlying concepts of Sonic Aid use, and could adapt a training scheme to suit a particular client. It would appear, especially from the attitudes of the present subjects, that a certain amount of time should be spent in explaining these concepts and developing a flexible course around them, rather than teaching exercises and routines in vacuo. If the turnover of clients is high, the latteris probably inevitable to a certain extent. But a trained instructor is in a stronger position than a lay guide, who does not even understand the importance of the exercises himself quite often, to put these routines across to the client.

6. Recommendations.

6.1 The Sonic Aid as a primary Mobility Aid.

The evidence of the present evaluation would suggest that the Sonic Aid can now be thought of as a primary mobility aid, comparable in terms of speed and efficiency, with the Long Cane (5.1.)

6.2 Use of Qualified Instructors.

This Manual was written on the assumption that there would be a sighted friend to help the blind user.

By now, December 1969, a recommendation has been made that training should be provided by qualified mobility instructors. These instructors would of course be expected to have received appropriate training in giving Sonic Aid instruction.

The use of an untrained friend as trainer in this type of high level skill acquisition does not seem to be appropriate. It is suggested that the original intention of Mr. Elliott, the author of the Manual, be implemented - i.e. of using trained instructors to carry out the Sonic Aid training. This could be done in a residential day centre, or domiciliary setting.

6.3 Provision of shorter courses

It is recommended that the present Manual incorporates Appendix A and B of this report. These appendices would outline shortened courses, derived from the main Manual, for clear path travel and environment sensing respectively. Potential clients could then be given the choice of one or other course, or both, depending upon their initial inclinations and capabilities (6.5.)

(a) Abbreviation of taped material and low level exercises.

The large amount of taped material in the course seemed to offer a disincentive to the present subjects rather than an incentive (4.2, 4.13.) It would seem more appropriate to have only one or two sets of taped examples (not tests) of pitch-distance relationships; two sets of surface discrimination examples; and two of investigation examples. The Elliotts' experience with blind subjects suggests that these tape-recordings were of interest to the subjects. The in viva applications and tests (of the investigation test battery 2.24 and Tables I and II) would appear to be far more useful in learning these skills.

Similarly with the low level exercises. Some of these have been retained in Appendices A and B. Others could be added from the Manual if necessary, though those in the Appendices would appear to be sufficient. Also, the techniques of the rapid scan in obstacle avoidance has been omitted as it seemed to be unnecessary for the subjects.

(b) Continuous scanning technique.

The continuous scan (4.5) seemed to be a far more flexible and comfortable one than the discrete scan recommended by the Manual. The possible lowering in safety by using a continuous scan was not obvious, and indeed at the end of training no collisions with obstacles in the path of the subjects occurred.

(c) Correction by veering on clear path travel.

This simple technique (4.8) while not mentioned in the Manual, seemed to be very suitable for keeping to a straight line while following a shoreline. It is suggested that it be incorporated in the course on clear path travel.

(d) Use of a test battery in Investigations

The test battery (2.24) provided a great deal of information about the whole range of investigation requirements and with it, it is possible to pick out the weak areas in the trainees abilities. Its inclusion in a course on environment sensing seems to be indicated.

6.4 Pretraining in basic mobility skills.

The one week of pretraining in basic unsighted mobility (2.9) seemed to be highly effective in the present evaluation. The subjects began learning the Sonic Aid when they were already quite highly mobile with no aid except the short cane. This led to a smooth introduction of the Aid. It is

suggested that future clients be trained in the basic mobility skills if not already proficient in them.

6.5 Choice of Clients.

Despite its many advantages, the Sonic Aid, like the Long Cane, cannot provide continuous and full body protection. Thus, there are certain restrictions on the user population which should be considered:

(a) Clients should capable of making inferences rapidly.

(b) Ideally they should use the aid over familiar routes as far as possible.

(c) Clients should be capable of coping with unexpected low obstacles, e.g. downkerbs - if missed with the Aid.

Appendix A. Course for clear path travel.

Section 1 - Introducing the Aid:

Lesson 1	All items
Lesson 2	Items 2 and 3
PD 1 (a)	Continuous slow guided movement to and from a wall

Section 2 - Pitch/Distance relationships:

PD 1 (b)	Continuous slow guided movements to Halt, Touch, Collide
PD 1 (d)	Continuous unguided movements to Halt
PD 1 (f)	Deciding whether you are nearer a wall than Halt
-	Short tape giving examples of the sounds associated with 1,3,5,7,9 feet from a reflector.
PD 9 (a)	Initial demonstration of 1,3,5,7,9 feet from a reflector
PD 9 (b)	Naming the 1,3,5,7,9 foot echoes
PD 11 (a)	Moving to 1,3,5,7, 9 feet from reflector
PD 8 (b)	Calling stop when Pedestrian reaches an agreed distance from Learner
PD 8 (d)	Pedestrian and Learner approach each other. As an addition, have Learner step to one side at an agreed distance and carry on walking in the original direction

Section 3 - Reference Walking along shorelines:

PD 6 (d)	Reference walking along a plain wall
PD 6 (f)	Reference walking along a wall where the surfaces change
Fourth Walk	Reference walking along a fence of laps away or mesh with regular spaced posts

Lesson 3 Item 5 Reference walking around curves and corners - e.g. end of blocks

\- Reference walking along complex shorelines of changing textures and irregularly spaced gateways, pipes etc.

Section 4 - Scanning Exercises:

Scan 1 Scanning across 3 canes)
Scan 2 Scanning across 3 canes)
Scan 3 Scanning with Aid turned off)
Scan 4 Co-ordinating scan with foot movements)

using a continuous scan rather than a discrete scan (2.16 and 4.5)

Section 5 - Scanning and following a shoreline:

Scan 6 Walking and scanning alongside a wall

\- Veering Technique (see 4.8)

Then as in Section 3, but incorporating the scanning technique. Next increase the complexity of the walks by using walks with kerbside furniture - trees etc.

PD 8 (d) This exercise to be carried out in the street situation using the scanning technique and regaining the straight line after the Learner has passed the Pedestrian.

Section 6 - Obstacle Avoidance:

BW 7 Locating and passing through a gap between two objects. To be practised also in the street situation using the short horizontal scan to find the clear path round obstacles

Ob 3 Avoiding low obstacles

Ob 4 Curbs

Ob 5 Curbs

Order of Presentation of Sections:

Section 1 should be taught first.

Section 2, 3, and 4 can then be taught concurrently, allowing about $\frac{1}{3}$ of each lesson for each section. For a Learner with particular aptitude, the sections could be integrated, perhaps introducing Pedestrian avoidance exercises during Reference Walking et. For slower Learners, it may be advisable to treat the sections separately, and concentrate on the lower level exercises more. The veering technique from section 5 could be introduced in the Reference Walks also.

Section 5 and 6 can lastly be taught concurrently, gradually increasing the complexity of shoreline, kerbside furniture, and density of obstacles and pedestrians.

Throughout the course the exercises should be practised with both hands, and when walking the hand nearer the shoreline should hold the Aid.

N.B. Tape recording is used for only one exercise in this course - before PD 9 (a) is attempted.

Appendix B. Course for Environment Sensing.

Section 1 - Introducing the Aid:

Lesson 1	All Items
Lesson 2	Items 2 and 3
PD 1 (a)	Continuous slow guided movement to and from a wall

Section 2 - Pitch/Distance relationships:

PD 1 (b)	Continuous slow guided movements to Halt, Touch, Collide
PD 1 (d)	Continuous unguided movements to Halt
PD 1 (f)	Deciding whether you are nearer a wall than Halt
-	Short tape giving examples of the sounds associated with 1,3,5,7,9 feet from a reflector.
PD 9 (a)	Initial demonstration of 1,3,5,7,9 feet from reflector.
PD 9 (b)	Naming the 1,3,5,7,9 feet echoes
PD 11 (a)	Moving to 1,3,5,7,9 feet from reflector
PD 8 (b)	Calling stop when Pedestrian reaches an agreed distance from Learner
PD 8 (d)	Pedestrian and Learner approach each other. As an addition, have Learner step to one side at an agreed distance and carry on walking in the original direction.

Section 3 - Investigation Sweeps:

Inv. 1	Width of Reflectors
Inv. 2	Control of Horizontal sweeps Also tape for Inv. 2

Inv. 3	Horizontal sweeps over familiar objects
Inv. 4	More Horizontal sweeps
Inv. 5	Technique for vertical sweeps
Inv. 6	Short tape recording for Inv.6
Inv. 7) Inv. 8) Inv. 9)	Introduce Learner to increasingly more complex objects and ask him to name the different parts of them using the terms in the Manual. The Learners descriptions of the parts of the objects should become increasinly more detailed - e.g. from "rough" to "hedge" or "railings".

Section 4 - Surface Discriminations:

Surf 1	As in Manual using taped examples and in vivo exercises
Surf 2	do
Surf 3	do
Surf 4	do

Order of Presentation os Sections:

Section 1 should be taught first.

Sections 2, 3, and 4 can then be taught concurrently.

Section 4 should be completed before Inv. 7, and the ability to discriminate surfaces can then be used in Invs. 7, 8, and 9.

N.B. Tape recordings are applicable in this course where mentioned. i.e. for Inv. 2, Inv. 6, Surfs. 1 - 4.

References.

1. Armstrong, J.D. A report on the visit to Nottingham of Miss Joan Woodcraft and Mr. John Williams, 15th - 16th November 1968. Department of Psychology, Unpublished report to the St. Dunstans Scientific Committee, Nottingham: Nottingham University 1969.

2. Cratty, B.J. and Williams, H.G. Perceptual Thresholds of Non-Visual Locomotion Part II. Department of Physical Education, Monograph (NIH Grant No. 05577 - 0251) Los Angeles, University of California, 1966.

3. Elliott, E. and Elliott, P.H. and Roskilly, D. A Manual of Instruction for use of the Kay Sonic Aid. London: St. Dunstan's Evaluation Unit 1967.

4. Leonard, J.A. and Carpenter, A. "Trial of an Acoustic Blind Aid" American Foundation for the Blind, Res. Bull. No.4 (1964) pp 70 - 119.

5. Norton, F.T.M. Improving and Accelerating the Process of Raising the Hearing of Blinded Persons to a Greater Degree of Useness. Cleveland Society for the Blind. Cleveland Ohio 1956 - 1960.

6. Pare, J.C.F. Personal Communication 1969.

7. Wolpe, J. and Lazarus, A.A. Behavour Therapy Techniques. New York: Pergammor Press 1966.

8. Ed. Dufton, R. Proceedings of the International Conference of Sensory Devices for the Blind. London: St. Dunstans 1966.

9. Editorial New Beacon. May 1968.

Acknowledgements

This evaluation was made possible by a grant from St. Dunstan's. The work was carried out under the direction of Dr. J.A. Leonard. My thanks are due to Dr. J. Armstrong, Mr. and Mrs. E. Elliott and Miss J.C.F. Pare for their help and advice during this research.

My thanks also to my four subjects - Mr. J. Adams, Miss H. Kahn, Mrs. H. Sharpe and Mr. D. Gosling for their regular and sustained appearance throughout the course and for the many invaluable comments which they made upon the exercises.

Finally, my thanks to Mr. S. Grainger for his help with filming, and to Mrs. G. Heitzman for typing this report.

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Sharpe, Robert.
THE EVALUATION OF THE ST. DUNSTAN'S MANUAL OF INSTRUCTION FOR THE KAY SONIC AID.
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